

REMARKS

The Final Office Action dated February 17, 2004, has been received and reviewed.

Claims 1, 2, 4, 5, and 7-46 are currently pending and under consideration in the above-referenced application. Each of claims 1, 2, 4, 5, and 7-46 stands rejected.

Reconsideration of the above-referenced application is respectfully requested.

Information Disclosure Statement

Please note that a Supplemental Information Disclosure Statement was filed in the above-referenced application on September 8, 2003, but that the undersigned attorney has not yet received any indication that the references cited in the Supplemental Information Disclosure Statement have been considered in the above-referenced application. It is respectfully requested that the references cited in the Supplemental Information Disclosure Statement of September 8, 2003, be considered and made of record in the above-referenced application and that an initialed copy of the Form PTO/SB/08A that accompanied that Supplemental Information Disclosure Statement be returned to the undersigned attorney as evidence of such consideration.

Rejections Under 35 U.S.C. § 112, First Paragraph

Claims 1, 2, 4, 5, and 7-46 stand rejected under 35 U.S.C. § 112, first paragraph, for reciting subject matter which has allegedly not been described in the specification of the above-referenced application in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention.

Specifically, the Office has asserted that the recitation "consisting essentially of" in claims 1 and 20 is a negative limitation and, therefore, constitutes new matter. This is purportedly because the originally-filed specification of the above-referenced application does not limit a dry etchant to including a first component and a second component having the features that are recited in independent claim 1 or the at least one fluorocarbon recited in independent claim 20.

It is respectfully submitted that independent claims 1 and 20 are in condition for allowance under 35 U.S.C. § 112, first paragraph.

The transitional phrase “consisting essentially of” is not a negative limitation or an exclusionary phrase. M.P.E.P. § 2173.05(i) identifies negative limitations as limitations that “define the invention in terms of what it [is] not . . .” The M.P.E.P. goes so far as to provide examples of negative limitations, including “other than,” “being free from,” and “incapable of.” M.P.E.P. § 2173.05(i). The M.P.E.P. does not, in section 2173.01(i) or elsewhere, define the transitional phrase “consisting essentially of” as a negative limitation or an exclusionary phrase.

Instead, as the Office has already pointed out, M.P.E.P. § 2111.03 indicates that “‘consisting essentially of’ . . . occupies a middle ground between the closed claims that are written in a ‘consisting of’ format and fully open claims that are drafted in a ‘comprising’ format.” While the M.P.E.P. expressly provides that the transitional phrase “consisting of” is exclusionary, it merely indicates that the transitional phrase “‘consisting essentially of’ limits the scope of a claim to the specified materials or steps ‘and those that do not materially affect the basic and novel characteristic(s)’ of the claimed invention.” M.P.E.P. § 2111.03 (citation omitted). It is understood that M.P.E.P. § 2111.03 places the “burden of showing that the introduction of additional steps or components would materially change the characteristics of [the claimed] invention” on the applicants if they “contend[] that additional steps or materials in the prior art are excluded by the recitation of ‘consisting essentially of.’”

Nowhere does the M.P.E.P. state that “consisting essentially of” can only be used in a claim where that exact phrase, or some negative limitation or exclusionary phrase, appears in the specification.

The specification of the above-referenced application describes dry etchants that include all of the essential elements that are recited in independent claims 1 and 20. The specification of the above-referenced application also lacks any mention of an etchant which includes a component other than those recited in claims 1 and 20 that would “‘materially alter the novel and basic characteristics’ of the claimed invention.” In fact, in describing examples of inventive etchants, the specification does not mention that the disclosed dry etchant includes any essential

elements other than a $C_2H_xF_y$ component and, optionally, one or more fluorocarbons, such as CF_4 or CHF_3 .

Independent claim 1 recites a dry etchant consisting essentially of a first component and a second component, the second component consists of at least one fluorocarbon, which could clearly include a single fluorocarbon, such as CF_4 or CHF_3 , or a combination of fluorocarbons.

Independent claim 20 recites a dry etchant consisting essentially of at least one fluorocarbon. Again, the at least one fluorocarbon could include a $C_2H_xF_y$, CF_4 , CHF_3 , another fluorocarbon, or any combination of fluorocarbons.

Both the Examiner and the Board have already made abundantly clear their positions that substitution of one fluorocarbon for another would be readily within the skill of one of ordinary skill in the art, as they all have similar properties, are "equivalent," and have "similar etching characteristics." *See e.g.*, Final Office Action, page 4. This reasoning is contradicted by the Office's new position that various combinations of fluorocarbons, including $C_2H_xF_y$ and CHF_3 could "alter the various characteristics of [an] etchant." Final Office Action, page 6.

As fluorocarbons are a specific class of components with characteristics that, according to the Office, are similar to one another, it is respectfully submitted that any combination of fluorocarbons would not materially alter the characteristics of the claimed etchant. Further, it is respectfully submitted that the inclusion of "consisting essentially of" in independent claims 1 and 20 merely serves to limit the additional elements of a dry etchant to those which do not materially alter the characteristics of the dry etchant.

With this in mind, the only mention of anything other than a $C_2H_xF_y$ component and one or more fluorocarbons, such as CF_4 or CHF_3 , is made at page 10, lines 14-16, of the specification of the above-referenced application, where use of a carrier gas with the etchant is mentioned. As is well known in the art, a carrier gas is not part of the etchant, but merely facilitates delivery thereof to the substrate to be etched. In fact, the specification of the above-referenced application, at page 12, lines 10-12, provides that the etchant may be introduced into an etch chamber with or without a carrier gas.

Therefore, it is respectfully submitted that independent claims 1 and 20 comply with the requirements of the first paragraph of 35 U.S.C. § 112. The sole basis for rejecting claims 2, 4,

5, 7-19, and 21-46 under 35 U.S.C. § 112, first paragraph, is their dependencies from claims 1 and 20. Accordingly, it is also respectfully submitted that each of claims 2, 4, 5, 7-19, and 21-46 is also in condition for allowance under 35 U.S.C. § 112, first paragraph.

Claim 18 has been rejected because the specification of the above-referenced application purportedly fails to provide an adequate written description for the recitation of an etchant that includes a first component and a primary etchant “etches doped silicon dioxide at a same rate as” doped silicon dioxide is etched by another “etchant that includes [the] primary etchant but not the first component.” Support for this recitation is provided, for example, at page 9, lines 19-22, of the specification of the above-referenced application, which describes an etchant that “permit[s] [a] doped silicon dioxide etch to proceed at a substantially normal rate.”

Therefore, it is respectfully submitted that, under 35 U.S.C. § 112, first paragraph, claim 18 is in condition for allowance.

In view of the foregoing, it is respectfully requested that the 35 U.S.C. § 112, first paragraph, rejections of claims 1, 2, 4, 5, and 7-46 be withdrawn.

Rejections Under 35 U.S.C. § 112, Second Paragraph

Claims 1, 2, 4, 5, and 7-46 stand rejected under 35 U.S.C. § 112, second paragraph, for purportedly being indefinite. More specifically, these claims have been rejected because independent claims 1 and 20 recite “consisting essentially of,” an allegedly close-ended term, but are modified by open-ended claims.

The basis for this rejection is unclear. Neither the Patent Office Rules (37 C.F.R.) nor the M.P.E.P. prohibit structuring claims in this manner; apparently because dependent claims that include the transitional term “comprising” further limit an element of the close-ended “consisting essentially of” group.

It is respectfully submitted that the recitation of “comprising” in the dependent claims cannot negate the effect of the recitation of “consisting essentially of” in the independent claims. The independent claims recite dry etchants that consist essentially of one or more particular

elements. Of the elements recited, *at least one* fluorocarbon is included. By reciting what the *at least one* fluorocarbon “comprises,” the dependent claims merely introduce additional limitations; the use of “comprising” in the dependent claims does not make it possible for the *at least one* fluorocarbon of the independent claims to include anything other than (besides nonessential components) one or more fluorocarbons.

Therefore, it is respectfully submitted that claims 1, 2, 4, 5, and 7-46 comply with the requirements of the second paragraph of 35 U.S.C. § 112. Accordingly, it is respectfully submitted that each of these claims is in condition for allowance and requested that the 35 U.S.C. § 112, second paragraph, rejections of these claims be withdrawn

Rejections Under 35 U.S.C. § 103(a)

Claims 1, 2, 4, 5, and 7-46 stand rejected under 35 U.S.C. § 103(a) for reciting subject matter which is assertedly unpatentable over that taught in U.S. Patent 5,814,563 to Ding et al. (hereinafter “Ding”), in view of teachings from U.S. Patent 5,626,716 to Bosch et al. (hereinafter “Bosch”).

The standard for establishing and maintaining a rejection under 35 U.S.C. § 103(a) is set forth in M.P.E.P. § 706.02(j), which provides:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Ding teaches, among other things, a dry etch process in which a chemical combination that includes a fluorocarbon gas, an ammonia-generating (NH₃-generating) gas, and a carbon-oxygen gas is used to dry etch dielectric materials such as doped and undoped silicon dioxide. *See, e.g.*, col. 2, lines 32-43. Ding also teaches that, by use of the chemical combination

disclosed therein, dielectric materials, such as doped and undoped silicon oxides, may be removed with selectivity over underlying substrate materials, such as silicon or gallium arsenide. *See, e.g.*, col. 3, lines 49-54. Ding further provides that the dry etchant chemical combination etches dielectric materials with selectivity over both photoresist materials and polysilicon. Col. 7, lines 44-49. Among the various fluorocarbons that are specifically disclosed in Ding as being useful in the chemical combination are CHF_3 and $\text{C}_2\text{H}_4\text{F}_2$. *See, e.g.*, col. 2, line 62, to col. 3, line 2.

Ding teaches that the ammonia-generating gas is an essential part of the dry etchant mixture disclosed thereon. *See, e.g.*, col. 6, lines 14-50.

Bosch teaches a dry etch process in which a chemical combination that includes CHF_3 (Freon-23) and neon (Ne) is used to remove doped silicon oxide with selectivity over undoped silicon oxide, silicon nitride, silicides, and silicon. *See, e.g.*, col. 2, lines 34-44. Any of these materials may, therefore, be used as an etch stop when a doped silicon oxide is being dry etched with the disclosed combination of CHF_3 and Ne. *See, e.g.*, col. 4, lines 43-48. Bosch does not disclose, teach, or suggest any dry etchant chemical combination that includes $\text{C}_2\text{H}_x\text{F}_y$, where x is an integer from three to five, inclusive, y is an integer from one to three, inclusive, and $x + y = 6$. Nor does Bosch disclose, teach, or suggest that any such dry etchant chemical combination may be used to dry etch doped silicon oxide with selectivity over undoped silicon oxide or even that doped silicon oxide may be dry etched with such a chemical combination.

Bosch also repeatedly emphasizes the importance of including Ne in the dry etchant. *See, e.g.*, col. 2, lines 45-48; col. 5, lines 38-41; col. 6, lines 13-28. More specifically, Bosch teaches that Ne imparts the dry etchant mixtures disclosed therein with selectivity. In this regard, Bosch teaches that Ne is an essential ingredient of the dry etchants disclosed therein. *See id.*; *see also* col. 5, lines 34 & 35.

Independent claim 1 recites a dry etchant which *consists essentially of* a first component and a second component. The first component of the dry etchant recited in independent claim 1 has the general formula $\text{C}_2\text{H}_x\text{F}_y$, where x is an integer from three to five, inclusive, y is an integer from one to three, inclusive, and $x + y = 6$. The second component of the dry etchant of amended

independent claim 1 consists of at least one fluorocarbon. The dry etchant is formulated to etch doped silicon dioxide with selectivity over at least undoped silicon dioxide.

Independent claim 20 recites a dry etchant which consists essentially of at least one fluorocarbon. The at least one fluorocarbon of amended independent claim 20 includes a component which comprises $C_2H_xF_y$, where x is an integer from three to five, inclusive, y is an integer from one to three, inclusive, and $x + y = 6$. In addition, amended independent claim 20 recites that the dry etchant thereof is formulated to etch doped silicon dioxide at a faster rate than at least undoped silicon dioxide.

It is respectfully submitted that Ding and Bosch do not support a *prima facie* case of obviousness against any of claims 1-38 since Ding and Bosch both teach away from the subject matter recited in claims 1-38.

In particular, Ding teaches a dry etchant combination which requires one or more fluorohydrocarbon gases, one or more NH_3 -generating gases, and a carbon-oxygen gas. Col. 2, lines 37-43; col. 2, lines 52-61. Bosch teaches a dry etchant combination which, in addition to a fluorocarbon, must also include Ne. *See, e.g.*, col. 2, lines 45-48; col. 5, lines 34 & 35; col. 5, lines 38-41; col. 6, lines 13-28.

In contrast, independent claim 1 recites a dry etchant which *consists essentially of* a first component comprising $C_2H_xF_y$, where x is an integer from three to five, inclusive, y is an integer from one to three, inclusive, and $x + y = 6$, and a second component consisting of at least one fluorocarbon. While this language does not exclude the presence of components, such as a carrier gas, which are not essential to the characteristics of the recited dry etchant, it does exclude other components, such as an NH_3 -generating gas or a carbon-oxygen gas, that would materially alter the characteristics of the recited dry etchant. *See* M.P.E.P. § 2111.03. In fact, Ding, at col. 2, lines 46-51, notes that the NH_3 -generating gas is at least partially responsible for accelerated dielectric etch rates when a photoresist is also present.

Likewise, independent claim 20 is drawn to a dry etchant which *consists essentially of* at least one fluorocarbon.

As Ding and Bosch teach dry etchants which include fluorocarbons, as well as additional, nonfluorocarbon ingredients which are essential to the desired functions of such dry etchants, these references both teach away from the subject matter recited in amended independent claims 1 and 20, it is respectfully submitted that the subject matter recited in these claims is allowable over the combination of Ding and Bosch.

Due to the presence of additional ingredients in the dry etchants taught in Ding and Bosch, one of ordinary skill in the art could not reasonably expect the asserted combination of teachings from Ding and Bosch to successfully result in the claimed subject matter.

Moreover, as Ding and Bosch both teach dry etchant mixtures which include something more than fluorocarbons, it is respectfully submitted that neither Bosch nor Ding, taken separately or together, teaches or suggests a dry etchant that *consists essentially of* either the elements recited in independent claim 1 or those recited in independent claim 20.

Claims 2, 4, 5, 7-19, and 39-42 are each allowable, among other reasons, for depending either directly or indirectly from claim 1, which is allowable.

Claims 21-38 and 43-46 are each allowable, among other reasons, for depending either directly or indirectly from claim 20, which is allowable.

In view of the foregoing, it is respectfully submitted that a *prima facie* case of obviousness has not been established against any of claims 1, 2, 4, 5, or 7-46.

For these reasons, withdrawal of the 35 U.S.C. § 103(a) rejections of claims 1, 2, 4, 5, and 7-46 is respectfully requested.

CONCLUSION

It is respectfully submitted that each of claims 1, 2, 4, 5, and 7-46 is allowable. An early indication of the allowability of each of these claims and an indication that the above-referenced application has been passed for issuance are respectfully solicited. If any issues preventing allowance of the above-referenced application remain which might be resolved by way of a telephone conference, the Office is kindly invited to contact the undersigned attorney.

Respectfully submitted,



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